APPENDIX A

FIELD PROCEDURES

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Test Borings

Drilling

Borings were drilled using a CME 55 trailer mounted drill rig. A rotary method of drilling was used to advance 3.25 inch I.D. hollow-stem augers. At borings locations where fill or waste fill materials did not exist (MW-2 through MW-4), the augers were advanced to a depth of approximately 9 feet. The augers were then removed, 6-inch I.D. galvanized steel casing placed to a depth of 9 feet and the borehole advanced to ground water using a 5-5/8-inch diameter tricone bit with compressed air as the drilling fluid. Once ground water was encountered, compressed air was no longer capable of lifting cuttings to ground surface. Potable water then replaced compressed air as the drilling fluid and the borehole was advanced to termination depth.

Soil samples were collected at approximately 5 or 10 foot intervals at the direction of the field supervisor. When sampling depth was reached, a split-spoon sampler was lowered down the borehole. The sampler was then driven into subsurface materials using repeated blows by a 140-pound hammer falling 30 inches. After the sample was obtained, it was removed from the sampler, classified and placed in a capped glass jar for storage. Samples collected below the depth where ground water was encountered were stored in glass jars specially cleaned and provided by

RECRA Research, Inc. The boring was then advanced to the next sample depth.

At boring locations MW-1 and MW-5 the presence of fill and waste-fill required special drilling techniques to limit the potential of contaminating materials underlying the fill materials. At borehole MW-1, 3.25 inch hollow-stem augers were advanced until non-fill materials were encountered. A split spoon sample was then collected and the borehole advanced an additional 3 feet, where another split spoon sample was collected to verify residual materials and not earthen fill had been encountered.

The augers were then removed and the borehole reamed to a diameter of approximately ten inches using a ten-inch drag bit. Six-inch I.D. galvanized steel pipe with threaded couples was then placed to borehole bottom and driven approximately 10 inches into residual material using repeated blows by a 300-pound hammer. Grout was then placed in the annular space between the borehole wall and steel casing to ground surface and allowed to harden. The borehole was then advanced as previously described to termination depth.

At borehole MW-5, 3.25-inch I.D. hollow-stem augers were advanced through fill and waste fill materials. Samples were collected continuously using a split spoon sampler. When non-fill materials were encountered, the augers were pulled and 4-inch I.D. galvanized steel casing with threaded couples were placed in the borehole. The steel casing was then driven one foot into alluvial material and the annular space grouted to

ground surface. The borehole was then advanced as previously described using a 3-inch diameter spade bit. Split-spoon samples were collected continuously to termination depth.

To limit the amount of aerosol oils, discharging from the air compressor, entering the borehole while drilling with air, an oil filter was placed in-line between the drill rig and air compressor. The oil filter used was a Van Air Systems, Inc. Model Number CL900 oil coalescer with Part Number CE-15 filter elements. The rated efficiency of this coalescer is 99.9 percent of oils removed.

Cleaning Methods

Prior to commencement of drilling activities a cleaning station was established near the entrance to the property and adjacent to the sole source of potable water at the project site. The cleaning station consisted of an electrically driven, kerosene fired portable steam cleaning rig and sawhorses for placement of equipment.

Before drilling at each of the borehole locations the drill rig was moved to the cleaning station. Augers, drill rods, bits, pipe wrenches and supporting tools and equipment were removed from the drill rig and placed on sawhorses. The rig and equipment were then rinsed off with potable water to remove any large build-up of cuttings followed by a thorough steam cleaning. Equipment was reloaded onto the drill rig and the rig mobilized to the next boring location. An exception to this procedure was necessary following completion of drilling activities at borings

MW-3, MW-4 and MW-1 due to the breakdown of the steam cleaning rig. Prior to drilling MW-2 and completion of drilling at MW-5 (48 to 64 feet) the drill rig and equipment were mobilized to a nearby fire station. At the fire station tools and equipment were placed on sawhorses and the rig and equipment thoroughly cleaned using potable water under very high pressure flowing through a fire hose connected to a fire hydrant.

Permeability Testing

Field permeability tests were performed in four of the five wells installed at the test boring locations. Monitoring well MW-5 was dry following construction. These permeability tests or "slug" tests were performed by raising or lowering the water level in the well with a weighted float (slug in) or bailer (slug out) and subsequently measuring the gradual water level decline or rise with an electric tape. In the case of "slug in", once the water level reached static conditions the float was removed from the well (slug out) and the recovering water level was measured.

Water level information was plotted on semilog graph paper on the linear axis against time in seconds on the log axis (Lohman, 1979). A family of matching curves were overlain on the data plot so that the plotted data points best fit one of the type curves. A value of time (t) in seconds on the data plot was picked where the data coordinate was found to overlie the value of $Tt/rc^2 = 1.0$ on the type curve. Once the value of t (seconds) was obtained it was used in the equation:

WATER LEVEL READINGS

Monitoring Well: MW-1
Ground Surface Elevation (M.P.): 252.87 ft.; 77.08 m
Top of Casing Elevation (M.P.): 255.70 ft.
Aquifer Screened: Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
8-12-83	Top of Casing, 24 Hours After Well Installation	86.83	168.87
8-15-83	Top of Casing, Prior to Development	99.79	155.91
8-15-83	Top of Casing, Immediately After Development	116	139.7
8-18-83	Top of Casing, Prior to Bailing	101.08	154.62
8-18-83	Top of Casing, Immediately After Bailing	128.08	127.62
8-19-83	Top of Casing, Prior to Washing Hole With Rig	108.67	147.03
8-19-83	Top of Casing, After Bailing To Remove Drill Water	114.67	141.03
8-20-83	Top of Casing	102.01	153.69
8-25-83	Top of Casing	111.0	144.7
9-1-83	Top of Casing	114.5	141.2
9-13-83	Top of Casing	125.08	130.62
9-20-83	Top of Casing	128.58	127.12

WATER LEVEL READINGS

Monitoring Well — MW-2
Ground Surface Elevation (M.P.) — 230.41 ft.; 70.23 m
Top of Casing Elevation (M.P.) — 235.36 ft.
Aquifer Screened — Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
8-12-83	Top of Casing, Water Level After Taking 29 Ft. Sample, Drilled With Air	27.08	208.28
8-12-83	Top of Casing, at 0915 Hours	26.83	208.53
8-12-83	Top of Casing, at 0930 Hours	25.17	210.19
8-12-83	Top of Casing, at 0945 Hours	24.67	210.69
8-13-83	Top of Casing	36.11	199.25
8-18-83	Top of Casing	37.2	198.16
8-18-83	Top of Casing, 100 Bails Later	37.1	198.26
8-19-83	Top of Casing	37.2	198.16
8-20-83	Top of Casing	37.1	198.26
8-25-83	Top of Casing	36.5	198.86
9-1-83	Top of Casing	36.3	199.06
9-13-83	Top of Casing	36.92	198.44
9-20-83	Top of Casing	37.5	197.86

WATER LEVEL READINGS

Monitoring Well	MW-3
Ground Surface Elevation (M.P.)	232.86 ft.; 70.98 m
Top of Casing Elevation (M.P.)	236.78 ft.
Aquifer Screened	Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
7-27-83	Top of Casing, Water Level Measured After Blowing Hole With Air	64	172.78
7-28-83	Top of Casing, 24 Hours TOB	51	185.78
8-1-83	Top of Casing	53.54	183.24
8-3-83	Top of Casing	53.65	183.13
8-5-83	Top of Casing	53.72	183.06
8-8-83	Top of Casing	53.72	183.06
8-9-83	Top of Casing	53.81	182.97
8-12-83	Top of Casing	54.03	182.75
8-16-83	Top of Casing	54.25	182.53
8-18-83	Top of Casing	54.46	182.32
8-18-83	Top of Casing, Water Level After 31 Bails	82.25	154.53
8-18-83	Top of Casing, 1605 Hours	70.75	166.03
8-19-83	Top of Casing	57.56	179.22
8-20-83	Top of Casing	55.64	181.14
8-25-83	Top of Casing	55.4	181.38
9-1-83	Top of Casing	54.9	181.88
9-13-83	Top of Casing	55.33	181.45
9-20-83	Top of Casing	55.0	181.78

WATER LEVEL READINGS

Monitoring Well: MW-4
Ground Surface Elevation (M.P.): 237.66 ft.; 72.44 m
Top of Casing Elevation (M.P.): 242.84 ft.
Aquifer Screened: Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
8-2-83	Top of Casing, Water Level After Blowing Open Hole With Air to Remove Drilling Water	83	159.84
8-3-83	Top of Casing, 24 Hours TOB Open Hole	71	171.84
8-5-83	Top of Casing	55.31	187.53
8-8-83	Top of Casing	65.7	177.14
8-9-83	Top of Casing	65.54	177.3
8-12-83	Top of Casing	70.75	172.09
8-15-83	Top of Casing, Prior to Air Development	66.33	176.51
8-16-83	Top of Casing, 24 Hours After Air Development	68.5	174.34
8-18-83	Top of Casing, Prior to Development	73.0	169.84
8-18-83	Top of Casing, After 62 Bails	73.66	169.18
8-18-83	Top of Casing, Recovery After Bailing	73.49	169.35

WATER LEVEL READINGS

Monitoring Well	MW-4
Ground Surface Elevation (M.P.)	237.66 ft.; 72.44 m
Top of Casing Elevation (M.P.)	242.84 ft.
Aquifer Screened	Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
8-19-83	Top of Casing, 24 Hours After Development	73.17	169.67
8-20-83	Top of Casing, 24 Hours After Permeability Test	73.0	169.84
8-25-83	Top of Casing, 4 Days After Sampling	72.0	170.84
9-1-83	Top of Casing	72.6	170.24
9-13-83	Top of Casing	73.17	169.67
9-20-83	Top of Casing	73.5	169.34

WATER LEVEL READINGS

Monitoring Well MW-5
Ground Surface Elevation (M.P.) 187.95 ft.; 57. m
Top of Casing Elevation (M.P.) 192.35 ft.
Aquifer Screened Alluvium, Ponce, Juana Diaz

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
8-25-83	Top of Casing	60.4	131.95*
9-1-83	Top of Casing	60.4	131.95*
9-13-83	Top of Casing	60.25	132.1
9-20-83	Top of Casing	59.67	132.68

* Dry when installed

WATER LEVEL READINGS

Piezometer C-1
Ground Surface Elevation (M.P.) 268.7 ft.; 81.9 m
Top of Casing Elevation (M.P.) 271.5 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
2-25-83	Ground Surface	63.0	205.7
3-31-83	Ground Surface	70.3	198.4
4-4-83	Ground Surface	72.8	195.9
4-8-83	Ground Surface	72.0	196.7
4-12-83	Top of Casing	76.3	195.2
4-13-83	Top of Casing	76.4	195.1
5-25-83	Top of Casing, Water Level Difficult to Determine	71.9	199.6
7-21-83	Top of Casing, Water Level Difficult to Determine	86	185.5
8-20-83	Top of Casing, Water Level Difficult to Determine	81.83	189.67
8-25-83	Top of Casing, Water Level Difficult to Determine	81.9	189.60
9-1-83	Top of Casing Water Level Easy to Read	81.9	189.6

WATER LEVEL READINGS

Piezometer C-3
Ground Surface Elevation (M.P.) 160.1 ft.; 48.8 m
Top of Casing Elevation (M.P.) 163.3 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-1-83	Ground Surface	52.6	107.5
3-9-83	Ground Surface	52.5	107.6
3-31-83	Ground Surface	72.5	87.6
4-4-83	Ground Surface	78.5	81.6
4-8-83	Ground Surface	73.0	87.1
4-12-83	Top of Casing	77.1	86.2
4-13-83	Top of Casing	77.0	86.3
5-25-83	Top of Casing	77.18	86.12
7-21-83	Top of Casing	77.40	85.9
8-20-83	Top of Casing	76.91	86.39
8-25-83	Top of Casing	77.0	86.3
9-1-83	Top of Casing	76.9	86.4

WATER LEVEL READINGS

Piezometer C-4
Ground Surface Elevation (M.P.) 294.9 ft.; 89.87 m
Top of Casing Elevation (M.P.) 297.0 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-8-83	Ground Surface	154.5	140.4
3-10-83	Ground Surface	150.4	144.5
3-22-83	Ground Surface	149.5	145.4
3-28-83	Ground Surface	149.5	145.4
4-4-83	Ground Surface	138.0	156.9
4-8-83	Ground Surface	149.6	145.3
4-12-83	Top of Casing	151.4	145.6
4-13-83	Top of Casing	151.5	145.5
5-25-83	Top of Casing	150.8	146.2
8-20-83	Top of Casing	149.8	147.2
8-25-83	Top of Casing	149.8	147.2
9-1-83	Top of Casing	149.8	147.2

WATER LEVEL READINGS

Piezometer C-5
Ground Surface Elevation (M.P.) 288.4 ft.; 87.9 m
Top of Casing Elevation (M.P.) 291.2 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-11-83	Ground Surface	72.5	215.9
3-22-83	Ground Surface	78.0	210.4
3-28-83	Ground Surface	78.5	209.9
4-4-83	Ground Surface	84.7	203.9
4-8-83	Ground Surface	85.7	202.7
4-12-83	Top of Casing	87.4	203.8
4-13-83	Top of Casing	89.5	201.7
5-25-83	Top of Casing, Water Level Difficult to Determine	78.27	212.93
7-21-83	Top of Casing, Water Level Difficult to Determine	97.3	193.9
8-20-83	Top of Casing, Water Level Difficult to Determine	101.52	189.68
8-25-83	Top of Casing, Water Level Difficult to Determine	100.1	191.1
9-1-83	Top of Casing Water Level Difficult to Read	100.2	191.0

WATER LEVEL READINGS

Piezometer C-6
Ground Surface Elevation (M.P.) 244.3 ft.; 74.46 m
Top of Casing Elevation (M.P.) 251.8 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-22-83	Top of Casing	125.0	126.8
3-28-83	Top of Casing	124.0	127.8
3-31-83	Top of Casing	127.5	124.3
4-4-83	Top of Casing	126.5	125.3
4-8-83	Top of Casing	126.0	125.8
4-12-83	Top of Casing	125.6	126.2
4-13-83	Top of Casing	125.3	126.5
5-25-83	Top of Casing	120.0	131.8
7-21-83	Top of Casing	114.0	137.8
8-20-83	Top of Casing	111.35	140.45
8-25-83	Top of Casing	111.0	140.8
9-1-83	Top of Casing	110.4	141.4

WATER LEVEL READINGS

Piezometer C-15
Ground Surface Elevation (M.P.) 279.9 ft.; 85.32 m
Top of Casing Elevation (M.P.) 282.8 ft.
Aquifer Screened Ponce Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-25-83	Ground Surface	259.5	20.4
3-28-83	Ground Surface	259.5	20.4
3-28-83	Ground Surface	259.8	20.1
3-31-83	Ground Surface	259.8	20.1
4-4-83	Ground Surface	259.7	20.2
4-8-83	Ground Surface	258.3	21.6
4-12-83	Top of Casing	262.8	20.0
4-13-83	Top of Casing	262.7	20.1
5-25-83	Top of Casing	263.17	19.63
7-21-83	Top of Casing	262.6	20.2
8-20-83	Top of Casing	263.49	19.31
8-25-83	Top of Casing	263.7	19.1
9-1-83	Top of Casing	263.6	19.2

WATER LEVEL READINGS

Piezometer C-16
Ground Surface Elevation (M.P.) 220.2 ft.; 67.1 m
Top of Casing Elevation (M.P.) 223.6 ft.
Aquifer Screened Juana Diaz Formation

DATE	M.P./REMARKS	WATER LEVEL BELOW M.P. (ft.)	ELEVATION OF WATER LEVEL (ft.)
3-25-83	Ground Surface	167.5	52.7
3-28-83	Ground Surface	130.0	90.2
4-4-83	Ground Surface	104.7	115.5
4-8-83	Ground Surface	101.5	118.7
4-12-83	Top of Casing	101.8	121.8
4-13-83	Top of Casing	101.8	121.8
5-25-83	Top of Casing	99.39	124.16
7-21-83	Top of Casing	97.3	126.25
8-20-83	Top of Casing	96.95	126.6
8-25-83	Top of Casing	96.8	126.75
9-1-83	Well vandalized no reading possible due to obstruction above water table	-	-